CLAIMS

1. In a graphics processing system, a method for calculating texture coordinates for a texture map having an acceptable range of coordinate values, comprising remapping an input texture coordinate value located outside the acceptable range of coordinate values to a corresponding texture coordinate located within the acceptable range of coordinate values based on the sign of the input texture coordinate value and location of the input texture coordinate value relative to the acceptable range.

2. The method of claim 1 wherein remapping comprises:

determining whether the input texture coordinate value is within one of a plurality of predefined negative or positive input ranges or the acceptable range;

calculating a texture coordinate value for each of the predefined input ranges; and

selecting the corresponding texture coordinate from the calculated texture coordinate values and the input texture coordinate value based on the sign of the input texture coordinate value and the calculated texture coordinate values.

3. The method of claim 2 wherein remapping is performed for each axis of the texture map.

4. The method of claim 2 wherein calculating the texture coordinates comprises:

where the sign of the input texture coordinate value is negative, calculating a first value A = [input + (1 * tex_size)] and a second value B = [input + (2 * tex_size)]; and

otherwise, calculating a first value A = [input - (1 * tex_size)] and a second value B = [input + (2 * tex_size)],

where input is the input texture coordinate value and tex_size is the size of the texture map.

5. The method of claim 2 wherein selecting the corresponding texture coordinate comprises:

where the sign of the input texture coordinate value is negative, selecting B when (A < 0), otherwise selecting A as the corresponding texture coordinate; and

where the input texture coordinate value is equal to zero or the sign of the input texture coordinate is positive, selecting the input texture coordinate value when (A <0), selecting A when (B < 0), and selecting B otherwise.

6. The method of claim 2 wherein calculating the texture coordinates comprises:

where the sign of the input texture coordinate value is negative, calculating a first value A = [input + (1 * tex_size)] and a second value B = [input + (2 * tex_size)];

otherwise, calculating a first value A = [input - (1 * tex_size)] and a second value B = [input + (2 * tex_size)]; and

calculating a third value C = (tex_size - A),

where input is the input texture coordinate value and tex_size is the size of the texture map.

7. The method of claim 6 wherein selecting the corresponding texture coordinate comprises:

where the sign of the input texture coordinate value is negative, selecting B when (A < 0), otherwise selecting C as the corresponding texture coordinate; and

where the input texture coordinate value is equal to zero or the sign of the input texture coordinate value is positive, selecting the input texture coordinate value when (A < 0), selecting C when (B < 0), and selecting B otherwise.

8. The method of claim 2 wherein calculating the texture coordinates comprises:

where the sign of the input texture coordinate value is negative, calculating a first value A = [2 * tex_size] and a second value B = [input + (2 * tex_size)];

otherwise, calculating a first value A = [- 2 * tex_size + 1LSB] and a second value B = [input - (2 * tex_size)]; and

calculating a third value C = (0 - A),

where input is the input texture coordinate value, tex_size is the size of the texture map, and 1LSB is a binary value equal to 1 and having a bit length the same as the tex_size.

9. The method of claim 8, further comprising clamping the corresponding texture coordinate to a clamped value, and wherein selecting the corresponding texture coordinate comprises:

where the sign of the second value B is negative, selecting C as the corresponding texture coordinate; and

otherwise, selecting the input texture coordinate value as the output texture coordinate.

10. A method of calculating a texture coordinate for a texture map from an input texture coordinate value located in one of a plurality of predefined input ranges, comprising:

calculating a plurality of texture coordinate values corresponding to the plurality of predefined input coordinate ranges in accordance with the sign of the input coordinate value;

selecting an output texture coordinate from the plurality of calculated texture coordinate values and the input texture coordinate value based on the sign of the input texture coordinate and the sign of the calculated texture coordinate values.

11. The method of claim 10 wherein calculating a plurality of texture coordinates comprises:

where the sign of the input texture coordinate is negative, calculating a first value A = [input + (1 * tex_size)] and a second value B = [input + (2 * tex_size)]; and

otherwise, calculating a first value A = [input - (1 * tex_size)] and a second value B = [input + (2 * tex_size)],

where input is the input texture coordinate value and tex_size is the size of the texture map.

12. The method of claim 11 wherein selecting an output texture coordinate comprises:

where the sign of the input texture coordinate is negative, selecting B when (A < 0), otherwise selecting A as the output texture coordinate; and

where the input texture coordinate is equal to zero or the sign of the input texture coordinate is positive, selecting the input texture coordinate when (A <0), selecting A when (B < 0), and selecting B otherwise.

13. The method of claim 10 wherein calculating a plurality of texture coordinates comprises:

where the sign of the input texture coordinate is negative, calculating a first value A = [input + (1 * tex_size)] and a second value B = [input + (2 * tex_size)];

otherwise, calculating a first value A = [input - (1 * tex_size)] and a second value B = [input + (2 * tex_size)]; and

calculating a third value C = (tex_size - A),

where input is the input texture coordinate value and tex_size is the size of the texture map.

14. The method of claim 13 wherein selecting an output texture coordinate comprises:

where the sign of the input texture coordinate is negative, selecting B when (A < 0), otherwise selecting C as the output texture coordinate; and

where the input texture coordinate is equal to zero or the sign of the input texture coordinate is positive, selecting the input texture coordinate when (A< 0), selecting C when (B < 0), and selecting B otherwise.

15. The method of claim 10 wherein calculating a plurality of texture coordinates comprises:

where the sign of the input texture coordinate is negative, calculating a first value A = [2 * tex_size] and a second value B = [input + (2 * tex_size)];

otherwise, calculating a first value A = [- 2 * tex_size + 1LSB] and a second value B = [input - (2 * tex_size)]; and

calculating a third value C = (0 - A),

where input is the input texture coordinate value, tex_size is the size of the texture map, and 1LSB is a binary value equal to 1 and having a bit length the same as the tex_size.

16. The method of claim 15, further comprising clamping the selected output texture coordinate to a clamped value, and wherein selecting an output texture comprises:

where the sign of the second value B is negative, selecting C as the output texture coordinate; and

otherwise, selecting the input texture coordinate as the output texture coordinate.

17. The method of claim 16 wherein clamping the selected output texture coordinate comprises clamping the output texture coordinate to an edge value along an edge of the texture map.

18. The method of claim 16 wherein clamping the selected output texture coordinate comprises clamping the output texture coordinate to a border value one texel beyond the texture map.

19. The method of claim 16 wherein clamping the selected output texture coordinate comprises clamping the output texture coordinate to a coordinate value half of a texel beyond an edge of the texture map.

20. The method of claim 10 wherein calculating and selecting are repeated for each axis of the texture map.

21. In a graphics processing system, a method for calculating texture coordinates that are within an acceptable range of texture coordinates, comprising:

determining whether an input texture coordinate is located in the acceptable range of texture coordinates, or in one of a plurality of negative or positive input ranges defined outside of the acceptable range of input values;

calculating a coordinate value for each of the negative input ranges or positive input ranges in accordance with the sign of the input texture coordinate; and

selecting an output texture coordinate from the calculated coordinate values and the input texture coordinate in accordance with the sign of the input texture coordinate and the calculated coordinate values and a selected addressing mode.

22. The method of claim 21 wherein calculating the coordinate value comprises:

when calculating a texture coordinate in a first and second addressing mode,

calculating a first value A = [input + (1 * tex_size)] and a second value B = [input + (2 * tex_size)] where the sign of the input texture coordinate is negative;

otherwise, calculating a first value A = [input - (1 * tex_size)] and a second value B = [input + (2 * tex_size)]; and

calculating a third value C = (tex_size - A), and

when calculating a texture coordinate in a third addressing mode,

calculating a first value A = [2 * tex_size] and a second value B = [input + (2 * tex_size)] where the sign of the input texture coordinate is negative;

otherwise, calculating a first value A = [- 2 * tex_size + 1LSB] and a second value B = [input - (2 * tex_size)]; and

calculating a third value C = (0 - A),

where input is the input texture coordinate value, tex_size is the size of the texture map, and 1LSB is a binary value equal to 1 and having a bit length the same as the tex_size.

23. The method of claim 22 wherein selecting an output texture coordinate comprises:

in the first addressing mode,

where the sign of the input texture coordinate is negative, selecting B when (A < 0), otherwise selecting A as the output texture coordinate; and

where the input texture coordinate is equal to zero or the sign of the input texture coordinate is positive, selecting the input texture coordinate when (A <0), selecting A when (B < 0), and selecting B otherwise,

in the second addressing mode,

where the sign of the input texture coordinate is negative, selecting B when (A < 0), otherwise selecting C as the output texture coordinate; and

where the input texture coordinate is equal to zero or the sign of the input texture coordinate is positive, selecting the input texture coordinate when (A <0), selecting C when (B < 0), and selecting B otherwise, and

in the third addressing mode,

where the sign of the second value B is negative, selecting C as the output texture coordinate; and

otherwise, selecting the input texture coordinate as the output texture coordinate.

24. The method of claim 23, further comprising clamping the selected output texture coordinate to a clamped value in the third addressing mode.

25. The method of claim 21 wherein determining, calculating, and selecting are repeated for each axis of the texture map.

26. A texture addressing circuit for calculating texture coordinates for a texture map having a size and an acceptable range of input coordinate values, the circuit comprising:

a plurality of coordinate calculation circuits corresponding to a plurality of input coordinate ranges defined outside of the acceptable range for both negative and positive input coordinate values, each coordinate calculation circuit coupled to receive a signal corresponding to the sign of the input coordinate value and a respective texture size value corresponding to a multiple of the size of the texture map, each coordinate calculation circuit providing a respective coordinate output value;

a selection circuit coupled to receive as input values the input coordinate and the coordinate output values of the plurality of coordinate calculation circuits, the selection circuit selecting one of the input values as an output texture coordinate value; and

select logic coupled to the selection circuit and further coupled to receive input signals corresponding to the sign of the input coordinate value and the signs of the coordinate output values, the select logic providing a selection signal commanding the selection circuit to select one of the input values as the output texture coordinate in accordance with the received input signals.

27. The addressing circuit of claim 26 wherein first and second coordinate calculation circuits of the plurality comprise:

a negating circuit coupled to receive a respective texture size value and the signal corresponding to the sign of the input coordinate value, the negating circuit generating as an output value a positive or negative respective texture size value in accordance with the sign of the input coordinate value; and

a summing circuit having a first input coupled to receive the output value of the negating circuit and a second input for receiving a second input value, the summing circuit further having an output to provide the sum of the output value of the negating circuit and a value received by at the second input.

28. The addressing circuit of claim 27 wherein the negate circuit comprises:

an inverter having an input coupled to receive the signal corresponding to the sign of the input coordinate value and further having an output coupled to the summing circuit to provide a carry-in bit; and

an exclusive OR (XOR) gate having a first input coupled to the output of the inverter and a second output coupled to receive the respective texture size value, the XOR gate further having an output coupled to the summing circuit.

29. The addressing circuit of claim 27 wherein the first and second coordinate calculation circuits receive the texture size values tex_size and 2* tex_size, respectively, where tex_size is the size of the texture map, and for the first and second coordinate calculation circuits, the second input of the summing circuits are coupled to receive the input coordinate value and the output of the summing circuits are coupled to provide a respective coordinate output value to the selection circuit, the select logic generating a selection signal to select the output texture coordinate as follows:

if the sign of the input coordinate value is negative, and

if the sign of the coordinate output value of the first coordinate calculation circuit is negative, select the output of the second coordinate calculation circuit as the output texture coordinate,

otherwise select the output of the first coordinate calculation circuit as the output texture coordinate, and

if the sign of the input coordinate is not negative, and

if the sign of the coordinate output value of the first coordinate calculation circuit is negative, then select the input coordinate as the output texture coordinate,

otherwise,

if the sign of the coordinate output value of the second coordinate calculation circuit is negative, select the output of the first coordinate calculation circuit as the output texture coordinate,

otherwise select the output of the second coordinate calculation circuit as the output texture coordinate.

30. The addressing circuit of claim 27 wherein the first and second coordinate calculation circuits receive the texture size values tex_size and 2* tex_size, respectively, where tex_size is the size of the texture map, and for the first and second coordinate calculation circuits, the second input of the summing circuits are coupled to receive the input coordinate value and the output of the summing circuits of the second coordinate calculation circuit is coupled to provide a coordinate output value to the selection circuit, the addressing circuit further comprising:

a subtracting circuit having a first input coupled to the output of the summing circuit of the first coordinate calculation circuit and a second input coupled to receive the tex_size value, the subtracting circuit providing to the selection circuit at an output the difference of the output of the summing circuit of the first coordinate calculation circuit and the tex_size value.

31. The addressing circuit of claim 30 wherein the select logic generates a selection signal to select the output texture coordinate as follows:

if the sign of the input coordinate value is negative, and

if the sign of the coordinate output value of the first coordinate calculation circuit is negative, select the output of the second coordinate calculation circuit as the output texture coordinate,

otherwise select the output of the subtracting circuit as the output texture coordinate, and

if the sign of the input coordinate is not negative, and

if the sign of the coordinate output value of the first coordinate calculation circuit is negative, then select the input coordinate as the output texture coordinate,

otherwise,

if the sign of the coordinate output value of the second coordinate calculation circuit is negative, select the output of the subtracting circuit as the output texture coordinate,

otherwise select the output of the second coordinate calculation circuit as the output texture coordinate.

32. The addressing circuit of claim 27 wherein the first and second coordinate calculation circuits receive the texture size values tex_size and 2* tex_size, respectively, where tex_size is the size of the texture map, and for the second coordinate calculation circuit the second input of the summing circuit is coupled to receive the input coordinate and the output of the summing circuit is coupled to provide a coordinate output value to the selection circuit, for the first coordinate calculation circuit the second input of the summing circuit is coupled to receive a 1LSB binary value having 1 as its least significant bit, the addressing circuit further comprising:

a subtracting circuit having a first input coupled to the output of the summing circuit of the first coordinate calculation circuit and a second input coupled to receive a null value, the subtracting circuit providing the difference of the sum value and the null value to the selection circuit.

33. The addressing circuit of claim 27 wherein the select logic generates a selection signal to select the output texture coordinate as follows:

if the sign of the coordinate output value of the second coordinate calculation circuit is negative, select the output of the subtracting circuit as the output texture coordinate,

otherwise select the input coordinate as the output texture coordinate.

34. The addressing circuit of claim 27 having a clamping mode and wherein the second coordinate calculation circuit of the plurality receives the texture size value 2 * tex_size, where tex_size is the size of the texture map, and the second input of the summing circuit of the second coordinate calculation circuit is coupled to receive the input

coordinate value and the output of the summing circuit of the second coordinate calculation circuit is coupled to the selection circuit, and

the first coordinate calculation circuit of the plurality receives through a first multiplexer as the texture size value either tex_size or 2 * tex_size, and the second input of the summing circuit of the first coordinate calculation circuit is coupled to receive through a second multiplexer either the input coordinate value or a 1LSB binary value having 1 as its least significant bit, the output of the summing circuit of the first coordinate calculation circuit is coupled to provide a coordinate output value to the selection circuit,

the addressing circuit further comprising a subtracting circuit having a first input coupled to the output of the summing circuit of the first coordinate calculation circuit and a second input coupled to receive through a third multiplexer either the tex_size value or a null value, the subtracting circuit providing to the selection circuit at an output the difference of the output of the summing circuit of the first coordinate calculation circuit and the value received by the second input, the first, second, and third multiplexers providing the respective signals in accordance with the clamping mode.

35. The addressing circuit of claim 34, further comprising a clamping circuit coupled to receive the output texture coordinate of the selection circuit when in the clamping mode and provide a clamped output texture coordinate.